

REMARKS

Claims 2 and 11-30 have been canceled without prejudice. Claims 1 and 3-10 remain before the Examiner for reconsideration. Claims 1, 5, 6, 7 and 9 have been amended. The amendments to the claims are indicated in the Appendix hereto in which additions to the claims are marked by underlining and deletions from the claims are marked by bracketing.

In the outstanding Office Action, the Examiner maintained the rejection Claims 1-10 under 35 U.S.C. Section 102 (a or b) "as being anticipated by LeJeune et al (U), (V) or (W) or Havens et al for the type of reasons set forth in the previous office action of 11/6/01." Specifically, the Examiner further asserted that:

The claims require increasing enzyme activity at an enzyme loading of an enzyme immobilized in a polyurethane polymer by synthesizing the polymer in a reaction mixture containing the enzyme and a surfactant. LeJeune et al (U), (V) or (W) or Havens et al disclose immobilizing an enzyme in a polyurethane polymer by synthesizing the polymer in a reaction mixture containing the enzyme and a surfactant. Increased enzyme activity at an enzyme loading in the polymer will be inherent.

Applicant's arguments filed 5/6/02 have been fully considered but they are not persuasive.

Applicants urge that LeJeune et al do not use a sufficient amount of surfactant to increase enzyme activity at an enzyme loading. However, this has not been established by evidence. The amount of surfactant used by LeJeune et al would produce some increase in activity even if the increase is small. The claims do not require a greater amount of surfactant than used by LeJeune et al.

Applicants respectfully traverse the Examiner's rejection.

Once again, Applicants are not claiming merely the addition of surfactant during the synthesis of a polymer immobilizing an enzyme, but including a sufficient amount of a surfactant in the reaction mixture to increase enzyme activity at an enzyme

loading than is substantially higher than the enzyme loadings disclosed in LeJeune et al (U), (V) or (W) or Havens et al. Applicants have amended Claim 1 to set forth an enzyme loading of at least 0.1 weight percent.

In Havens et al., for example, a very crude (impure) protein preparation was used at a maximum concentration of 5mg/g polymer. Although this is 0.5 wt% of protein preparation, the concentration of enzyme in that preparation is much lower. Although not indicated, the enzyme loading in the polymer of Havens et al. is probably less than 0.01 wt%. In that regard, in LeJeune W, a purified enzyme at 0.006mg/g polymer (0.006 wt%) was used. The enzyme activity of the polymer of LeJeune W and Havens et al. is similar, indicating a similar enzyme loading.

Including a sufficient amount of a surfactant in the reaction mixture to increase enzyme activity at any enzyme loading, let alone the relatively high enzyme loading of the present invention, is not disclosed or suggested in LeJeune et al. (U), (V) or (W) or Havens et al. Moreover, contrary to the Examiner's earlier assertion, increased loading of enzyme in a polymer is not "inherent."

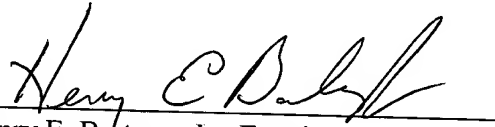
LeJeune et al. (U), (V) or (W) or Havens et al. disclose merely the known use of surfactants to achieve desirable physical properties of an enzyme-containing polyurethane polymer. LeJeune et al. (U), (V) or (W) or Havens et al. do not disclose or suggest that surfactants, when used in sufficient amounts, increase enzyme activity as claimed in the present invention. Indeed, Applicants are the first to discover that surfactants can be used to increase enzyme activity at relatively high enzyme loading. LeJeune et al. (U), (V) or (W) or Havens et al. do not even address the problem of retention of activity at high enzyme loadings. Through increased surfactant in the reaction mixtures of the present invention, relatively large quantities of enzymes are immobilized within the polymers of the present invention while retaining a significant portion of the native enzyme specific activity. Prior to the present invention, high enzyme loadings were not used because sufficient activity was not retained. The present invention thus provides a substantial improvement in the art.

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In light of the above remarks, Applicants respectfully request that the Examiner withdraw his rejection of Claims 1 and 3-10, and that the Examiner indicate the allowability of Claims 1 and 3-10 and arrange for an official Notice of Allowance to be issued in due course.

Respectfully submitted,

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Appendix: Version with markings to show changes made

1. (Once Amended) A method of increasing loading of active enzyme immobilized in a polyurethane polymer, the method comprising the steps of:

synthesizing the polyurethane polymer in a reaction mixture containing water and enzyme wherein an enzyme loading of the polyurethane polymer is greater than approximately 0.1 percent by weight of the polyurethane polymer; and

including a sufficient amount of a surfactant in the reaction mixture to increase enzyme activity at [an] the enzyme loading.

5. (Once Amended) The method of Claim [2] 1 wherein enzyme immobilized in the polyurethane polymer includes at least one of an oxidoreductase, a transferase, a hydrolase, a lyase, an isomerase or a ligase.

6. (Once Amended) The method of Claim [2] 1 wherein enzyme immobilized in the polyurethane polymer includes at least one of a protease, a lipase, a peroxidase, a tyrosinase, a glycosidase, a nuclease, an aldolase, a phosphatase, a sulfatase, or a dehydrogenase.

7. (Once Amended) The method of Claim [2] 1 wherein at least two species of enzyme are co-immobilized within the polyurethane polymer.

9. (Once Amended) The method of Claim [2] 1 wherein the surfactant comprises between 0.5 to 5.0 weight percent of the aqueous component of the mixture.